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The Feeding Value of Rumen Content-Maggot Meal Mixture in the Diets of Early Weaned Piglets

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Abstract: Forty five piglets weaned at 28 days of age were used in this experiment to investigate the effect of Rumen Content-Maggot Meal Mixture (RCMM) in their diet. RCMM was included at 0, 5, 10, 15 and 20%. Increasing the level of RCMM in the diets of weaned pigs had no significant effect ($p>0.05$) on weight gain and feed to gain ratio. However, the treatment had a significant effect ($p>0.05$) on feed intake. There was also no treatment effect ($p>0.05$) on nitrogen intake, urinary and feacal nitrogen and nitrogen digestibility. Feed cost slightly decreased from N22.87 at 0 to N22.56 at 20%. The results of this feeding trial showed that early weaned pigs could tolerate 10% RCMM in diet without any adverse effect on performance.

Key words: Rumen content-maggot meal mixture, early weaned piglets

INTRODUCTION

Poor productivity and high mortality of stock which characterize livestock industry in under-developed countries is largely explained by high cost of feeds due to stiff competition between humans and livestock species for available feedstuffs. However, almost all animal by-products can be used in the formulation of cheaper livestock feeds especially for monogastric animals (Sonaiya, 1987). Rumen Content (RC) which is an abattoir waste is the material obtained from rumen of slaughtered ruminant. It contains a mixed population of microbes and undigested feed. RC varies in composition with the feed and feeding practices given to animals prior to slaughter and with the types of processing method used. Microbes in the rumen convert nutrients such as cellulose and Non-Protein Nitrogen (NPN) into microbial proteins such that the rumen acts as a natural continuous system for the production of single cell proteins (Javanovic and Cuperloric, 1977). Ricci (1977) gave the crude protein composition of RC as determined or dry matter basis as 12.2% while Okorogbona (1994) reported 13.19% crude protein and Amoo (1990) gave the crude protein of RC as 13.5%. Hence, it is between 10-25% (Javanovic and Cuperloric, 1977).

Although RC is a cheap animal by-product with relatively good crude protein composition which has been fed to monogastrics (Adeniji, 2001). It is highly fibrous with up to 25% crude fibre (Ricci, 1977). The high fibre content has limited its use in monogastric nutrition. The pig is however, a non-ruminant that can utilize fibrous feed materials better than poultry and rabbits (McDonald *et al*., 1998).

Maggot meal is the processed housefly (*Musca domesticus*) larvae used in livestock feed. Calvert (1979) reported that housefly larvae or pupa could be highly compared with fishmeal or meat meal as a protein source. Rey *et al*. (1979) cultivated housefly larvae on urban refuse and after processing, the meal was analysed to contain 59% crude protein and 18% fat. Maggots are easily obtained in poultry farms, sedimented wastes and sewage and they can also be cultivated using different media that can attract housefly infestation which will cause laying of eggs wastes which have

no direct human consumption value and this makes it a cheap high quality protein source that effectively substitute expensive protein concentrates such as fishmeal, soyabean meal, groundnut, meat meal, blood meal etc. This study was aimed at determining the optimum inclusive level of RCMM that early weaned piglets can tolerate in their diet.

MATERIALS AND METHODS

A total of 45 early weaned pig (the piglets were weaned at 28 days of age) of mixed sexes were used in this experiment which lasted for eight weeks. The feeding trial was conducted in year 2003 at the Department of Animal Production, University of Ilorin, Ilorin. Nigeria. The piglets were assigned to 5 dietary treatments. Each treatment had 3 replicates and each replicate had three piglets. The five experimental diets (Table 1) had RCMM at 0, 5, 10, 15 and 20% levels.

The RC used was collected at slaughter time after the rumen was split open. The RC was processed by heating it at about 100^0C in a drum with constant stirring for 2.5 h, after which the RC was sun-dried to less than 12% moisture content. The RC was then milled and stored. The maggots used were collected at a poultry farm and processed by immersing a sack containing the maggots in boiling water for about 20 min. The dead maggots were then sun-dried and milled. The processed RC and maggot meal were mixed at a ratio of 3:1 weight for weight respectively. The RCMM was analysed to contain 17.17% CP.

The pigs were allowed to adapt to the diets and pens for a week prior to the 8 weeks data collection period. Feed and water were supplied *ad libitum*. Records of initial weight, weekly live weight and daily feed intake were kept; feed to gain ratio was calculated.

Digestibility trial was conducted over 72 h period in the seventh week of the experiment using the total collection method. During the digestibility trial the piglets were kept in metabolic cages for easy feaces and urine collection. Feaces collected was weighed then dried and stored while the urine was collected in plastic bottles and concentrated hydrochloric acid (HCl) was added as preservative. All proximate analysis were conducted using the methods of AOAC (1980) and all data collected were subjected to analysis of variance using the model for of complete randomized block design. Where significant treatments means were compared using Duncan's Multiple range test (Steel and Torrie, 1980).

Table 1: Composition of experimental diets (kg/100 kg)

	Diets				
Ingredients	1	2	3	4	5
Wheat offal	20.00	15.00	10.00	5.00	-
RCMM	-	5.00	10.00	15.00	20.00
Maize	40.00	40.00	40.00	40.00	40.00
Soybean	10.00	10.00	10.00	10.00	10.00
Corn bran	9.055	9.14	9.225	9.31	9.395
Kernel cake	9.055	9.14	9.225	9.31	9.395
Blood meal	7.84	7.64	7.50	7.33	7.16
Bone meal	2.50	2.50	2.50	2.50	2.50
Oyster shell	1.00	1.00	1.00	1.00	1.00
Salt	0.30	0.30	0.30	0.30	0.30
Vit. Premix*	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00
Proximate composition (Analyzed)					
Dry matter (%)	87.85	89.67	86.46	87.71	88.12
Crude protein (%)	19.11	18.75	19.00	18.25	18.10
M.E. (Rcal kg^{-1})	2,636.66	2,586.40	2,537.30	2,485.60	3,464.90

*: Biomix-Vit. Premix used contained Vit. A: 330,000IU; Vit D_3: 330,000IU; Vit E: 16,500IU, Vit A_3: 506 mg: Riboflavin: 3.3 g; Pantothenic acid: 9.9 g; Niacin: 11 g; Vit B_{12}: 20 MG; Chlorine: 220 g, Zinc: 207 g; Fe: 20.7 g; Copper: 2.07 g; Mg: 4.17 g; I: 62 mg; Se: 62 mg

RESULTS

The feed intake values for the piglets on the RCMM diets seem very comparable ($p>0.05$) with values ranging from 0.79 to 0.83 kg; except for the piglets on the 20% RCMM diet that had significantly lower ($p<0.05$) feed intake value of 0.74 kg (Table 2).

There was no significant effect of treatment on the weight gain values obtained. It seem as if the weight gain values decreased ($p>0.05$) as the RCMM level increased in the diet, with the piglets on the 15 and 20% RCMM diets gaining 0.21 and 0.20 kg, respectively compared with 0.23 kg gained by the piglets on 0 and 10% RCMM diets and the 0.22 kg gained by the piglets on the 5% RCMM diet.

The inclusion of the RCMM in the piglet diet had no significant effect on the feed to gain results. The piglets fed on the control diet tended to have the best feed to gain ratio of 3.43, while the piglets on the 15% RCMM diet had the highest ($p>0.05$) feed to gain ratio of 3.95.

Gradual reduction in cost of feed was observed from N22.87 at 0% RCMM to N21.56 at 20% RCMM. 10% RCMM gave the best feed cost of producing 1 kg live weight (N10.20) but this is highly comparable to that obtained at 20% RCMM (N10.22).

There was insignificant effect ($p>0.05$) of increasing RCMM level on feacal and urinary nitrogen, nitrogen intake, retained nitrogen and nitrogen digestibility. Nitrogen intake seems to ($p>0.05$) gradually reduce from a 0 (30.67) to 20% (23.87) RCMM. Feacal nitrogen tended to decrease ($p>0.05$) from 0 (9.23) to 20% (8.33) RCMM. Although, the value obtained at 20% RCMM is insignificantly higher than that of 5, 10 and 15% RCMM. Also, urinary nitrogen tended to increase from 0 to 10% and then seems to decrease from 10 to 20% RCMM (Table 3).

Nitrogen balance seems to decrease gradually ($p>0.05$) with increasing level of RCMM in the diets. Hence, 0% RCMM gave the highest retained nitrogen (23.90 g) while 20% RCMM gave the lowest value (13.07 g). The highest nitrogen digestibility value (70.75) was obtained on piglets fed the control diet but this value is insignificantly different ($p>0.05$) from 66.45, 72.66, 69.85 and 54.88 obtained at 5, 10, 15 and 20% RCMM, respectively.

Table 2: Effect of RCMM fed on the growth performance characteristics of piglets

Performance Characteristics	Levels of RCMM (%) 0	5	10	15	20	SEM
Initial body weight (kg pig^{-1})	6.83	6.50	6.83	7.00	7.00	
Final body weight (kg pig^{-1})	19.50	18.67	19.67	18.67	18.33	2.7^{NS}
Feed intake (kg pig^{-1} day^{-1})	0.79^{b}	0.81^{b}	0.83^{b}	0.83^{b}	0.74^{a}	2.5×10^{-3}
Weight gain (kg pig^{-1} day^{-1})	0.23	0.22	0.23	0.21	0.20	$3.4\times10^{-2\ NS}$
Feed gain ratio	3.43	3.68	3.61	3.95	3.70	0.43^{NS}
*Feed cost (N kg^{-1})	22.87	22.80	22.72	22.64	22.50	
Feed cost/body weight gain (N kg^{-1})	10.95	13.13	10.20	11.48	10.22	

NS: Not Significant; SEM: Standard Error of Means; *: N1 = $ 130 as at the time the experiment was conducted

Table 3: Effect of RCMM fed on the nitrogen digestibility of piglets

Parameters	Level of RCMM (%) 0	5	10	15	20	SEM
Nitrogen intake (g)	30.67	29.00	29.27	25.00	23.87	1.182^{NS}
Urinary nitrogen (g)	3.20	3.28	3.93	2.50	2.47	0.490^{NS}
Faecal nitrogen (g)	9.23	6.33	4.00	5.00	8.33	1.860^{NS}
Nitrogen output (g)	12.43	9.61	7.93	7.50	10.80	1.720^{NS}
Nitrogen retained (g)	23.90	19.38	21.33	17.50	13.07	1.183^{NS}
Nitrogen digestibility (%)	70.75	66.45	72.66	69.88	54.88	9.313^{NS}

NS: Not Significant difference; SEM: Standard Error of Mean

DISCUSSION

The insignificant effect of RCMM on weight gain and feed to gain ratio obtained in this study is similar to that of Emmanuel (1978) who reported that whole rumen content did not affect growth and feed conversion when included in broiler diets. This could be due to the fact that pigs tolerate considerable level of fibre in their diets (Javanovic and Cuperloric, 1977). Oyedeji (1989), who replaced dietary GNC with maggot meal also reported insignificant differences in weight gain, weight intake, feed conversion ratio and nutrient retention.

The slightly decreasing weight gains observed in the pigs with increasing level of RCMM in the diets is in agreement with the report of Adeniji (1996), that a decline in live weight gain of chicks was observed as higher levels of blood rumen content mixture was included in their diets. This decreasing weight gain may be as a result of the fibrous nature of RC in the RCMM mixture. The highest weight gain value obtained at 10% RCMM may be attributed to relatively high Crude Protein (CP) content (19%) as compared to that of 5, 15 and 20% RCMM. This CP value is however slightly lower than that of the control (19.11%), thus the weight gain values at 10% RCMM (0.31) is highly comparable to that of the control diet (0.30).

RCMM inclusion in the diets had a significant effect on feed intake. This is in accordance with the result obtained by Amoo (1990) who reported insignificant differences in weight gains and significantly effect on feed intakes of chicks fed different dietary levels of Decomposed Rumen Content (DRM). The decreasing feed intake of the pigs may be due to the decreasing Metabolizable Energy (ME) content of the diets from 0 to 15% RCMM. Since animals consume feed to meet their energy requirements (Atteh and Olobengla, 1993; Adeniji, 2001). Feed intake of pigs increased with decreasing ME of diets from 0 to 15% RCMM. Hence, this explains the reduced feed intake of pigs fed 20% RCMM since they consumed less to meet their energy requirement.

Decreasing feed cost with increasing Rumen level in the diets is explained by the inexpensiveness of rumen content and maggot meal. This reduced price implies that RCMM can be included in pigs feed to replace expensive conventional feedstuffs. The least cost of producing 1 kg live body weight was obtained at 10% RCMM (N10.20) and this is comparable to what was obtained at 20% RCMM (N10.22). However, the different (2 kobo) is negligible, compared to 6 kobo difference observed between the feed cost at 10 and 20%.

The insignificant difference in nitrogen intake, retained nitrogen and nitrogen digestibility may be attributed to the fat content of the diets contributed by the maggot meal. Maggots were reported to have 15% fat by Rey *et al*. (1979) and 20.76% by Atteh and Ologbenla (1993).

The apparent digestibility of protein is believed to be higher when diets are rich in unsaturated lipids. Hence, the insignificant difference in retained nitrogen and digestibility of pigs fed the control diet and the other test diets.

Low nitrogen digestibility observed in the pigs at varying levels of RCMM may be linked to the fibre content of the diets as a result of rumen content inclusion, since increased dietary fibre affects protein nutrition. (Delorme and Wojcik, 1983). This is because fibres are arranged in such a way that proteins are trapped within them, thus offering resistance to digestion by enzymes in the gastro intestinal tract of the animal.

The mortality recorded in this study at 0 RCMM and 5% RCMM cannot be attributed to RCMM inclusion in the diet since mortality occurs in pigs fed the control diet which is void of RCMM. Hence, the death of the pigs could be as a result of other sources than dietary effect.

In conclusion, this experiment results shows that RCMM can be included in pigs' diet without adverse effect on growth performance characteristics, although nitrogen digestibility was slightly reduced. For economic performance, 10% RCMM inclusion in the diet of early weaned piglets is recommended. This is in terms of feed to gain ratio and the cost of producing 1 kg body weight. The piglets on the 10% RCMM diet also had the best nitrogen digestibility.

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